Ministry of Higher Education and Scientific Research

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Mechanics of a Particle (Physics 1)

Problems & Exercises (of Chap 3)

Work and Energy

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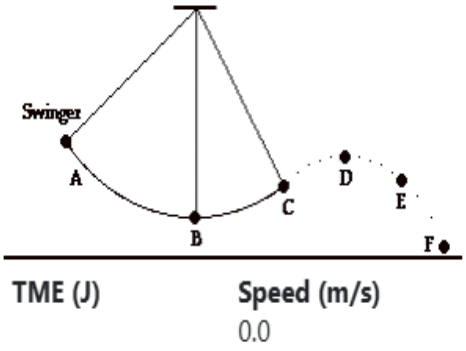
Exercise 1

A child is at the park with her father. The **26-kg** child is on a swing following the path as shown. The child has a speed of **0 m/s** at position **A** and is at a height of **3.0m** above the ground. At position **B**, the child is **1.2 m** above the ground. At position **C** (**2.2 m** above the ground), the child projects from the seat and travels as a projectile along the path shown. At point **F**, the child is a mere picometer above the ground. Assume negligible air resistance throughout the motion.



Use this information to complete the table below. **(g = 9.8 m/s^2)**

Position	Height (m)	PE (J)	KE (J)	TME (J)	Speed (m/s)
A	3.0				0.0
B	1.2				
C	2.2				
F	0.0				

Exercise 2

A solid body **S** with mass ***m*** attached on one side to a spring with stiffness ***K***, and the other side of the spring is fixed. The body is moved horizontally from its equilibrium position by a distance ***x*** and then released (**μ = tan φ**: coefficient of friction).

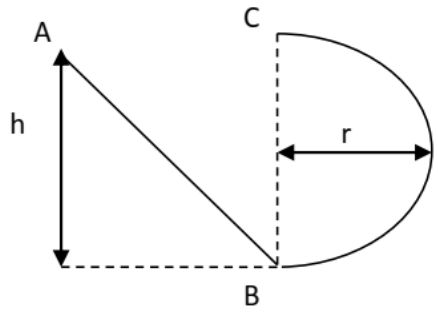
1- Illustrate the forces acting on body **S**.

2- Calculate the velocity V_B corresponding to the movement of **S** from its equilibrium position.

Exercise 3

A ball slides without friction inside a gutter.

Find the smallest height h_{min} from which the ball must be launched to reach point **C** without leaving the gutter. $(a = \frac{v_c^2}{r})$



Exercise 4

A material point of mass m is launched with an initial velocity $\vec{v}_A$ along an inclined plane making an angle α with the horizontal. After traveling a distance d, the material point reaches a spring with a natural (unstretched) length l_0 and a spring constant k. The spring undergoes compression due to the material point.

1. Determine the **forces acting** on the material point.
2. Calculate the **work** done by all these forces along the trajectory from the initial position **A** to the point where the spring is compressed.
3. Calculate the **maximum velocity** achieved by the material point.
4. Determine the **maximum compression** of the spring.